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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/566,216	01/27/2006	Yoshinori Shimizu	5232-0103PUS1	2018

2292 7590 11/12/2008
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EXAMINER	
CERULLO, LILIANA P	
ART UNIT	**PAPER NUMBER**
2629	

NOTIFICATION DATE	DELIVERY MODE
11/12/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/566,216	SHIMIZU ET AL.	
	Examiner	Art Unit	
	LILIANA CERULLO	2629	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 January 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 January 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/27/06 and 11/06/06*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

2. Claims 14-17 are objected to because of the following informalities: Claims 14-17 recite “a non-volatile memory capable of *receiving/providing* information”, it is unclear if the memory is capable of receiving and providing, or capable of receiving or providing.

For the purpose of examination, the examiner interpreted the latter.

Also, claims 14-17, recite “information…that is *received/provided by/from* the non-volatile memory”, it is unclear what added limitation is intended. For the purpose of examination, the examiner interpreted received, provided by and from the non-volatile memory to have the same meaning.

Furthermore, claims 3, 9 and 13 use the term “and/or”; it is unclear if the limitations using this term are expected to be in the alternative or not. For the purpose of examination the examiner interpreted the term "and/or" to mean "or".

Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. **Claims 1-4, 6-12 and 20** are rejected under 35 U.S.C. 102(b) as being anticipated by Muthu in US 6,411,046.

5. Regarding **claim 1**, Muthu teaches a light emitting apparatus (luminaire of col. 1 lines 6-10) comprising:

at least two light emitting elements (red, green and blue LEDs of col. 2 lines 67 to col. 3 line 2 and Fig. 1) with different chromaticities (green and blue LEDs are different colors and therefore have different chromaticities); and

a light emitting element controller (controllers 30 and 34 of Fig. 1) that controls light emitted from the light emitting apparatus (col. 3 lines 22-26, where microcontroller 34 controls the light output of the LEDs) so as to be a desired chromaticity (col. 3 lines 18-26, where the microcontroller controls light output based on calculated CIE xy coordinates, which are chromaticity coordinates), wherein

the light emitting element controller (controllers 30 and 34 of Fig. 1) controls the light emitting elements based on a predetermined function of light emitting element temperature variation (col. 3 lines 12-26 where the microcontroller derives equations for the chromaticity coordinates, CIE xy, as a function of different heat-sink temperatures).

6. Regarding **claim 2**, Muthu teaches the light emitting element controller (controllers 30 and 34 of Fig. 1) controlling drive currents (Fig. 1, where the controller 30 controls the power supply9, which supplies current to LEDs per col. 1 lines 65-67) of the light emitting elements (LEDs 10, 12 and 14 of Fig. 1) based on a predetermined function of light emitting element temperature variation (col. 3 lines 12-26 where the microcontroller derives equations for the chromaticity coordinates, CIE xy, as a function of different heat-sink temperatures).

7. Regarding **claim 3**, Muthu teaches a light emitting apparatus (luminaire of col. 1 lines 6-10) comprising:

at least two light emitting elements with different chromaticities (red, green and blue LEDs of col. 1 lines 67 to col3 line 2 and Fig. 1; because the LEDs have different colors, they have different chromaticity);

a light emitting element controller (controllers 30 and 34 of Fig. 1) that controls light emitted from the light emitting apparatus (col. 3 lines 22-26, where microcontroller 34 controls the light output of the LEDs) so as to be a desired chromaticity (col. 3 lines 18-26 where the microcontroller controls light output based on calculated CIE xy coordinates, which are chromaticity coordinates); and

storage (Fig. 1 memory 36) that previously stores drive current values (col. 3 lines 16-26 where the memory 36 stores drive current values in the form of CIE xy coordinates which are used to control the power supply 9 that feeds current to the LEDs through LED drivers 11, 13 and 15 of Fig. 1) for a plurality of light emitting element

temperatures (col. 3 lines 12-16 referring to different heat-sink temperatures) for controlling the light emitted from the light emitting apparatus so as to be the desired chromaticity (col. 3 lines 18-26 where the microcontroller controls light output based on calculated CIE xy coordinates, which are chromaticity coordinates), wherein

the light emitting element controller (controllers 30 and 34 of Fig. 1) controls drive currents of the light emitting elements (Fig. 1, where the controllers are connected to the power supply 9 that supplies the current to the LEDs through the LED drivers) based on the drive current values corresponding to a given temperature stored in the storage (CIE xy coordinates stores in memory 36 of Fig. 1 and explained in col. 3, lines 16-26).

8. Regarding **claim 4**, Muthu teaches a light emitting apparatus comprising (luminaire of col. 1 lines 6-10):

at least two light emitting elements with different chromaticities (red, green and blue LEDs of col. 1 lines 67 to col3 line 2 and Fig. 1; because the LEDs have different colors, they have different chromaticity);

a light emitting element controller (controllers 30 and 34 of Fig. 1) that controls light emitted from the light emitting apparatus (col. 3 lines 22-26, where microcontroller 34 controls the light output of the LEDs) so as to be a desired chromaticity (col. 3 lines 18-26, where the microcontroller controls light output based on calculated CIE xy coordinates, which are chromaticity coordinates); and

a temperature detector (Fig. 1, temperature sensor 33) wherein the light emitting element controller (controllers 30 and 34 of Fig. 1) controls the light emitting elements

based on a signal from the temperature detector (col. 3 lines 12-26 where the temperature sensor 33 feeds LED temperatures to the microcontroller 34, which controls the light output) and a predetermined function of light emitting element temperature variation (col. 3 lines 12-26 where the microcontroller derives equations for the chromaticity coordinates, CIE xy, as a function of different heat-sink temperatures).

9. Regarding **claim 6**, Muthu teaches a light emitting apparatus comprising (luminaire of col. 1 lines 6-10):

at least two light emitting elements with different chromaticities (red, green and blue LEDs of col. 1 lines 67 to col3 line 2 and Fig. 1; because the LEDs have different colors, they have different chromaticity);

a light emitting element controller (controllers 30 and 34 of Fig. 1) that controls light emitted from the light emitting apparatus (col. 3 lines 22-26, where microcontroller 34 controls the light output of the LEDs) so as to be a desired chromaticity (col. 3 lines 18-26, where the microcontroller controls light output based on calculated CIE xy coordinates, which are chromaticity coordinates); and

a temperature setter (microcontroller 34, which controls the color temperature of the LEDs after settings are inputted by a user, per. col. 3 lines 18-26), wherein

the light emitting element controller (controllers 30 and 34 of Fig. 1) controls the light emitting elements based on a value set in the temperature setter (setting inputted in the microcontroller 34 that controls color temperature of the LEDs per col. 3 lines 18-26) and a predetermined function of light emitting element temperature variation (col. 3

lines 12-26) where the microcontroller derives equations for the chromaticity coordinates, CIE xy, as a function of different heat-sink temperatures).

10. Regarding **claim 7**, Muthu teaches the light emitting element controller (controllers 30 and 34 of Fig. 1) controls light emitted from the light emitting apparatus (col. 3 lines 22-26, where microcontroller 34 controls the light output of the LEDs) so as to be a desired chromaticity (col. 3 lines 18-26, where the microcontroller controls light output based on calculated CIE xy coordinates, which are chromaticity coordinates) that belongs to white light (col. 3 lines 29-32).

11. Regarding **claim 8**, Muthu teaches the light emitting elements are light emitting diodes (col. 2 line 67 to col. 3 line 5).

12. Regarding **claim 9**, Muthu teaches LED lighting (luminaire of col. 1 lines 6-10) comprising:

LEDs with three different chromaticities of red, blue and green LEDs (red, green and blue LEDs of col. 2 line 67 to col 3 line 2 and Fig. 1; different colors have different chromaticities);

an LED controller (controllers 30 and 34 of Fig. 1) that controls light emitted from the LED lighting (col. 3 lines 22-26, where microcontroller 34 controls the light output of the LEDs) so as to be a desired chromaticity (col. 3 lines 18-26 where the

microcontroller controls light output based on calculated CIE xy coordinates, which are chromaticity coordinates);

the LED controller (controllers 30 and 34 of Fig. 1) controls drive currents of the LEDs (Fig. 1, where the controllers are connected to the power supply 9 that supplies the current to the LEDs through the LED drivers) based on a predetermined function of LED temperature variation (col. 3 lines 12-26 where the microcontroller derives equations for the chromaticity coordinates, CIE xy, as a function of different heat-sink temperatures) and thus controls the light emitted from the LED lighting so as to be white light (col. 3 lines 29-32), wherein

the LED controller drives one LED with any one of the chromaticities (Red, Green and BLUE LEDs col. 13 lines 18-22) at a constant current (When the forward current for the LED arrays is regulated by PWM, there is a constant peak current per col. 4 lines 26-36).

13. Regarding **claim 10**, Muthu teaches the red LED (col. 4 lines 27-34 where the forward current of the LED arrays are regulated, and col.2 line 67 to col. 3 line 2, where the LED array includes a RED LED 10) is driven at a constant current (When the forward current for the LED arrays, including the red LED, is regulated by PWM, there is a constant peak current per col. 4 lines 26-36).

14. Regarding **claim 11**, Muthu teaches the predetermined function of the temperature variation represents that the drive current is a linear function of the temperature (col. 2 lines 12-25, and linear functions of col. 5 lines 16-22).

15. Regarding **claim 12**, Muthu teaches LED lighting (luminaire of col. 1 lines 6-10) comprising:

LEDs with three different chromaticities of red, blue and green LEDs (red, green and blue LEDs of col. 2 line 67 to col 3 line 2 and Fig. 1; different colors have different chromaticities); and

an LED controller (controllers 30 and 34 of Fig. 1) that controls light emitted from the LED lighting (col. 3 lines 22-26, where microcontroller 34 controls the light output of the LEDs) so as to be a desired chromaticity (col. 3 lines 18-26 where the microcontroller controls light output based on calculated CIE xy coordinates, which are chromaticity coordinates) and a desired luminance (col. 3 lines 53-60 where lumen outputs are calculated based on the desired white color), wherein

the LED controller controls pulse drive periods (col. 4 lines 26-36 where the forward current for the LED arrays is subject to Pulse Width Modulation, therefore teaching control of the current pulse driving the LED arrays) of drive currents of the LEDs (forward current of col. 4 lines 26-36) based on a predetermined function of LED temperature variation (col. 3 lines 12-26 where the microcontroller derives equations for the chromaticity coordinates, CIE xy, as a function of different heat-sink temperatures) and thus controls the light emitted from the LED lighting so as to be white light (col. 3

lines 29-32) and thus controls the light emitted from the LED lighting so as to be white light with the desired luminance (col. 3 lines 48-60, where the required lumen output of the white light is based on the RGB light sources lumen outputs. As explained above, the RGB light sources are controlled by the controller).

16. Regarding **claim 20**, Muthu teaches control method of a light emitting apparatus (luminaire of col. 1 lines 6-10) that comprises at least two light emitting elements with different chromaticities (red, green and blue LEDs of col. 2 line 67 to col 3 line 2 and Fig. 1; different colors have different chromaticities), and a light emitting element controller (controllers 30 and 34 of Fig. 1) that controls light emitted from the light emitting apparatus so as to be a desired chromaticity (col. 3 lines 18-26 where the microcontroller controls light output based on calculated CIE xy coordinates, which are chromaticity coordinates), wherein the light emitting element controller controls the light emitting elements based on a predetermined function of light emitting element temperature variation (col. 3 lines 12-26 where the microcontroller derives equations for the chromaticity coordinates, CIE xy, as a function of different heat-sink temperatures).

Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

18. **Claim 5** is rejected under 35 U.S.C. 103(a) as being unpatentable over Muthu in US 6,411,046 in view of Ozaki in US 2003/0011553.

Muthu teaches a light emitting apparatus comprising (Muthu, luminaire of col. 1 lines 6-10):

at least two light emitting elements with different chromaticities (Muthu, red, green and blue LEDs of col. 1 lines 67 to col3 line 2 and Fig. 1; because the LEDs have different colors, they have different chromaticity);

a light emitting element controller (Muthu, controllers 30 and 34 of Fig. 1) that controls light emitted from the light emitting apparatus (Muthu, col. 3 lines 22-26, where microcontroller 34 controls the light output of the LEDs) so as to be a desired chromaticity (Muthu, col. 3 lines 18-26, where the microcontroller controls light output based on calculated CIE xy coordinates, which are chromaticity coordinates);

a temperature detector (Muthu, Fig. 1, temperature sensor 33); wherein

the light emitting element controller controls the light emitting elements based on signals from the temperature detector (Muthu, col. 3 lines 12-26 where the temperature sensor 33 feeds LED temperatures to the microcontroller 34, which controls the light

output), and a predetermined function of light emitting element temperature variation (Muthu, col. 3 lines 12-26 where the microcontroller derives equations for the chromaticity coordinates, CIE xy, as a function of different heat-sink temperatures).

Muthu also teaches a photosensor that senses the light intensity of all LED's in the array and which feedback that signal to the controller (Muthu, Fig. 1, photosensor 24 and col. 3 lines 6-11); however, Muthu fails to teach a drive time detector. Nonetheless, Ozaki teaches controlling the time an LED is ON in order to compensate for reduction of brightness (Ozaki, para. 101). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention, to use a drive time detector to control the duration of an LED ON-time in order to obtain the benefit of improved bright balance (as taught by Ozaki in para. 101), as the light intensity is already being measured in Muthu's apparatus, and Muthu's objective is to control color and light output automatically, continuously and on-line (Muthu, col. 1, lines 32-34).

19. **Claim 13** is rejected under 35 U.S.C. 103(a) as being unpatentable over Muthu in US 6,411,046 in view of Ozaki in US 2003/0011553 and Takeguchi in US 2002/0175632, and in further view of Sheu et al. in their "White Light Emission" article from the IEEE photonics (hereinafter Sheu).

Muthu teaches LED lighting (luminaire of col. 1 lines 6-10) comprising:

LEDs with four different chromaticities of red, blue and green LEDs, and another color LED (red, green, blue and amber LEDs of col. 2 line 67 to col 3 line 5; different colors have different chromaticities); and

an LED controller (controllers 30 and 34 of Fig. 1) that controls light emitted from the LED lighting (col. 3 lines 22-26, where microcontroller 34 controls the light output of the LEDs) so as to be a desired color rendering level (col. 3 lines 18-26 where the microcontroller controls light output based on calculated CIE xy coordinates);

a temperature detector (Fig. 1, temperature sensor 33), wherein

the LED controller (controllers 30 and 34 of Fig. 1) controls drive currents of the LEDs (Fig. 1, where the controllers are connected to the power supply 9 that supplies the current to the LEDs through the LED drivers) based on a detected value from the temperature detector (col. 3 lines 12-16), and a predetermined function of LED temperature variation (col. 3 lines 12-26 where the microcontroller derives equations for the chromaticity coordinates, CIE xy, as a function of different heat-sink temperatures) and thus controls the light emitted from the LED lighting so as to be the desired color (col. 3 lines 29-32), rendering level as white light (col. 3, lines 6-10), wherein

the LED controller drives one LED with any one of the chromaticities (Red, Green and BLUE LEDs col. 13 lines 18-22) at a constant current (When the forward current for the LED arrays is regulated by PWM, there is a constant peak current per col. 4 lines 26-36).

Muthu also teaches a photosensor that senses the light intensity of all LED's in the array and which feedback that signal to the controller (Muthu, Fig. 1, photosensor 24 and col. 3 lines 6-11); however, Muthu fails to teach a drive time detector or the fourth LED to be a white LED. Nonetheless, Ozaki teaches controlling the time an LED is ON in order to compensate for reduction of brightness (Ozaki, para. 101). Thus, it would

have been obvious to one of ordinary skill in the art at the time of the invention, to use a drive time detector to control the duration of an LED ON-time in order to obtain the benefit of improved bright balance (as taught by Ozaki in para. 101), as the light intensity is already being measured in Muthu's apparatus, and Muthu's objective is to control color and light output automatically, continuously and on-line (Muthu, col. 1, lines 32-34).

Muthu in view of Ozaki do not teach four LEDs. However, Takeguchi teaches an LED lighting that has four LEDs, including red, green, blue and white LEDs (Takeguchi, para. 16); thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to use an additional white LED in Muthu in view of Ozaki's apparatus, to obtain the benefit of expressing neutral without lowering brightness (as taught by Takeguchi in para. 14).

Neither Muthu, Ozaki nor Takeguchi teach the material characteristics of the white LED. However, Sheu teaches a white LED that can emit white light (Sheu, pg. 18, abstract) and is composed of a semiconductor light emitting element capable of emitting UV rays (Sheu, pg. 18, col 2, 1st para) and a phosphor emitting radiation caused by excitation of light emitted from the semiconductor light emitting element (Sheu, pg. 19, col. 1, 1st para in the middle, where it says that the LED chips pump phosphors). Therefore, it would also have been obvious to one of ordinary skill in the art at the time of the invention, to use a UV white LED which emits phosphors (as taught by Sheu), to obtain the added benefit of using a more optically stable white LED (as taught by Sheu in the abstract).

20. **Claims 14 and 16-19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Muthu in US 6,411,046 in view of Nagai et al. in US 2003/0016198 (hereinafter Nagai).

21. Regarding **claim 14**, Muthu teaches an LED light emitting apparatus (luminaire of col. 1 lines 6-10) comprising:

LEDs of at least red, blue and green colors (red, green, blue LEDs of col. 2 line 67 to col 3 line 2); and

a control portion (controllers 30 and 34, and memory 36 of Fig. 1) having a non-volatile memory (Fig. 1, memory 36) capable of receiving/providing information for chromaticity maintenance for temperature of the LED light emitting apparatus ((col. 3 lines 16-18 where chromaticity are the CIE xy coordinates);

a control circuit (controllers 30 and 34 of Fig. 1) that can read the information on respective colors (col. 3 lines 16-18 teaches the microcontroller 34 coupled to memory 36) and write control information into red, blue and green color setting registers (Lumen feedback controller 30 of Fig. 1, where is shown the controller providing lumen feedback to the LED drivers 11, 13 and 15),

a calculation circuit (microcontroller 34 of Fig. 1) that performs calculation based on signals from the respective color setting registers (col. 3 lines 12-16) and

a temperature information signal that is received from a temperature measurement element (temperature sensor 33 of Fig. 1 and col. 3 lines 12-16) through a temperature information processing portion (microcontroller 34 of Fig. 1), and

current sources (power supply 9) for respective colors that provide drive currents for the red, blue and green LEDs (as shown in Fig. 1), wherein

the information for chromaticity maintenance for temperature that is received/provided by/from the non-volatile memory contains predetermined functions ((col. 3 lines 12-26 where the microcontroller derives equations for the chromaticity coordinates, CIE xy, as a function of different heat-sink temperatures); a temperature coefficient (TH of col. 4 lines 50-60), and reference chromaticity and luminance data (col. 3 lines 48-60 where the chromaticity coordinates and lumen outputs are calculated for the white light chosen).

Muthu does not explicitly teach control circuit writing color information at power startup, or DACs from the calculation circuit.

However, Nagai teaches performing driving control of the LED currents (Nagai, para. 103) by controlling light variation based on chromaticity (Nagai, abstract) by powering on/off the main current (Nagai, para. 103), and also, DACs for chromaticity correction (Nagai, para. 133). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention, to perform control at power startup in Muthu's apparatus to obtain the benefit of chromaticity correction in one image of an image frame period (Nagai, para. 153), and furthermore, it would also have been obvious to use DACs to supply the chromaticity information from Muthu's controllers to the current drivers (Muthu's Fig. 1) to enable current supply to the LEDs with the chromaticity correction.

22. Regarding **claim 16**, Muthu teaches an LED light emitting apparatus (luminaire of col. 1 lines 6-10) comprising:

LEDs of at least red, blue and green colors (red, green, blue LEDs of col. 2 line 67 to col 3 line 2); and

a control portion (controllers 30 and 34, and memory 36 of Fig. 1) having a non-volatile memory (Fig. 1, memory 36) capable of receiving/providing information for chromaticity and luminance maintenance for temperature of the LED light emitting apparatus (col. 3 lines 16-26 where chromaticity are the CIE xy coordinates and luminance are lumen outputs);

a control circuit (controllers 30 and 34 of Fig. 1) that can read the information on respective colors (col. 3 lines 16-18 teaches the microcontroller 34 coupled to memory 36) and write control information into red, blue and green color setting registers (Lumen feedback controller 30 of Fig. 1, where is shown the controller providing lumen feedback to the LED drivers 11, 13 and 15),

a calculation circuit (microcontroller 34 of Fig. 1) that performs calculation based on signals from the respective color setting registers (col. 3 lines 12-16) and

a temperature information signal that is received from a temperature measurement element (temperature sensor 33 of Fig. 1 and col. 3 lines 12-16) through a temperature information processing portion (microcontroller 34 of Fig. 1), and

current sources (power supply 9) for respective colors that provide drive currents for the red, blue and green LEDs (as shown in Fig. 1), wherein

the information for chromaticity and luminance maintenance for temperature that is received/provided by/from the non-volatile memory contains predetermined functions ((col. 3 lines 12-26 where the microcontroller derives equations for the chromaticity coordinates, CIE xy, as a function of different heat-sink temperatures, and luminance is the lumen outputs); a temperature coefficient (TH of col. 4 lines 50-60), and reference chromaticity and luminance data (col. 3 lines 48-60 where the chromaticity coordinates and lumen outputs are calculated for the white light chosen).

Muthu does not explicitly teach control circuit writing color information at power startup, or DACs from the calculation circuit.

However, Nagai teaches performing driving control of the LED currents (Nagai, para. 103) by controlling light variation based on chromaticity (Nagai, abstract) by powering on/off the main current (Nagai, para. 103), and also, DACs for chromaticity correction (Nagai, para. 133). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention, to perform control at power startup in Muthu's apparatus to obtain the benefit of chromaticity correction in one image of an image frame period (Nagai, para. 153), and furthermore, it would also have been obvious to use DACs to supply the chromaticity information from Muthu's controllers to the current drivers (Muthu's Fig. 1) to enable current supply to the LEDs with the chromaticity correction.

23. Regarding **claim 17**, Muthu teaches the predetermined functions for the red, green and blue LEDs represents that control current values are first-order and second-

order polynomial functions of temperature (Muthu, col. 4 lines 42-60), but fails to explicitly teach cubic functions. However, Muthu also teaches that higher order polynomials can also be used (Muthu col. 4 lines 42-44), Thus, it would have obvious to one of ordinary skill in the art at the time of the invention to use a cubic function in order to more closely match the reference lumen to the heat-sink temperature (col. 4 line 65 to col. 5 line 7).

24. Regarding **claim 18**, Muthu teaches an LED light emitting apparatus (luminaire of col. 1 lines 6-10) comprising:

LEDs of red, blue and green colors (red, green, blue LEDs of col. 2 line 67 to col 3 line 2);

current sources for the LEDs of respective colors that are electrically connected to the LEDs (power supply 9 and current drivers 11, 13 and 15 of Fig. 1 as shown);

setting registers for the LEDs of respective colors (Lumen feedback controller 30 of Fig. 1, where is shown the controller providing lumen feedback to the LED drivers 11, 13 and 15);

a control circuit that is electrically connected to the setting registers (controllers 30 and 34 of Fig. 1); and

a non-volatile memory (Fig. 1, memory 36) that is electrically connected to the control circuit (as shown in Fig. 1), wherein

the control circuit includes temperature information through a temperature information (col. 3 lines 12-16) processing portion from a temperature sensing element of the LEDs (temperature sensor 33), wherein

the control circuit calculates control current values for LEDs of respective colors based on predetermined functions stored in the non-volatile memory (col. 3 lines 16-26 where the memory 36 stores drive current values in the form of CIE xy coordinates which are used to control the power supply 9 that feeds current to the LEDs through LED drivers 11, 13 and 15 of Fig. 1), and the temperature information that is provided therein (col. 3 lines 12-26, heat-sink temperatures), and thus performs light emission control drive of the LEDs based on the values that are provided into the setting registers (col. 3 lines 12-26, where the microcontroller 34 controls light output and color temperature, and as shown in Fig. 1 by the arrows, the microcontroller 34 feeds into lumen controller 30, which feeds into LED drivers 11, 13 and 15).

Muthu does not explicitly teach DACs from the calculation circuit.

However, Nagai teaches DACs for chromaticity correction (Nagai, para. 133). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention, to use DACs to supply the chromaticity information from Muthu's controllers to the current drivers (Muthu's Fig. 1) to enable current supply to the LEDs with the chromaticity correction.

25. Regarding **claim 19**, Muthu does not teach the LED materials. However, Nagai teaches the LEDs could be chosen from a group including AlGaInP and nitride groups (Nagai, para. 76). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to try using a red LED composed of a AlInGaP group semiconductor material (AlGaInP of Nagai's para. 76), and the blue and green LEDs are composed of a nitride group semiconductor material (e.g. GaN of Nagai's para. 76) in Muthu's apparatus; because as taught by Nagai, anyone of the materials will suffice for the LED and was available at the time of the invention, and thus, a person of ordinary skill in the art, would have been motivated to use the technology available at his/her grasp.

26. **Claim 15 is** rejected under 35 U.S.C. 103(a) as being unpatentable over Muthu in US 6,411,046 in view of Nagai et al. in US 2003/0016198 as applied to claim 14, in further view of Sawai in US 4,604,753.

27. Muthu in view of Nagai teach predetermined functions for green and blue LEDs represent that control current values are linear functions of temperature (Muthu, col. 5 lines 13-25); but fails to teach the predetermined function for the red LED to represent that a control current value is constant for temperature. However, Sawai teaches a laser diode that is maintained at a constant temperature, irrespective of the ambient temperature (Sawai, col. 2 lines 11-18) and therefore the forward current supplied to the laser diode is not increased with increase in temperature (Sawai, col. 7 lines 29-35). Thus, it would have been obvious to one of ordinary skill in the art at the time of the

invention to maintain any or all of the LEDs, for example the red LED, at a constant temperature, and consequently have the control current value for the red LED constant for different ambient temperatures (as taught by Sawai), in order to obtain a more precise temperature control in high ambient temperature (as taught by Saway in col. 7 lines 45-54 and lines 12-18).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Schuurmans in US 2003/0076056, Muthu et al. in US 2002/0097000 (different to the reference used above), Bielas in US 6,359,918 and Kamikawa et al. in US 6,628,249 teach methods and apparatuses for LED light output control based on temperature.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LILIANA CERULLO whose telephone number is (571)270-5882. The examiner can normally be reached on Monday to Thursday 8AM-4PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amr Awad can be reached on 571-272-7764. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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LC

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